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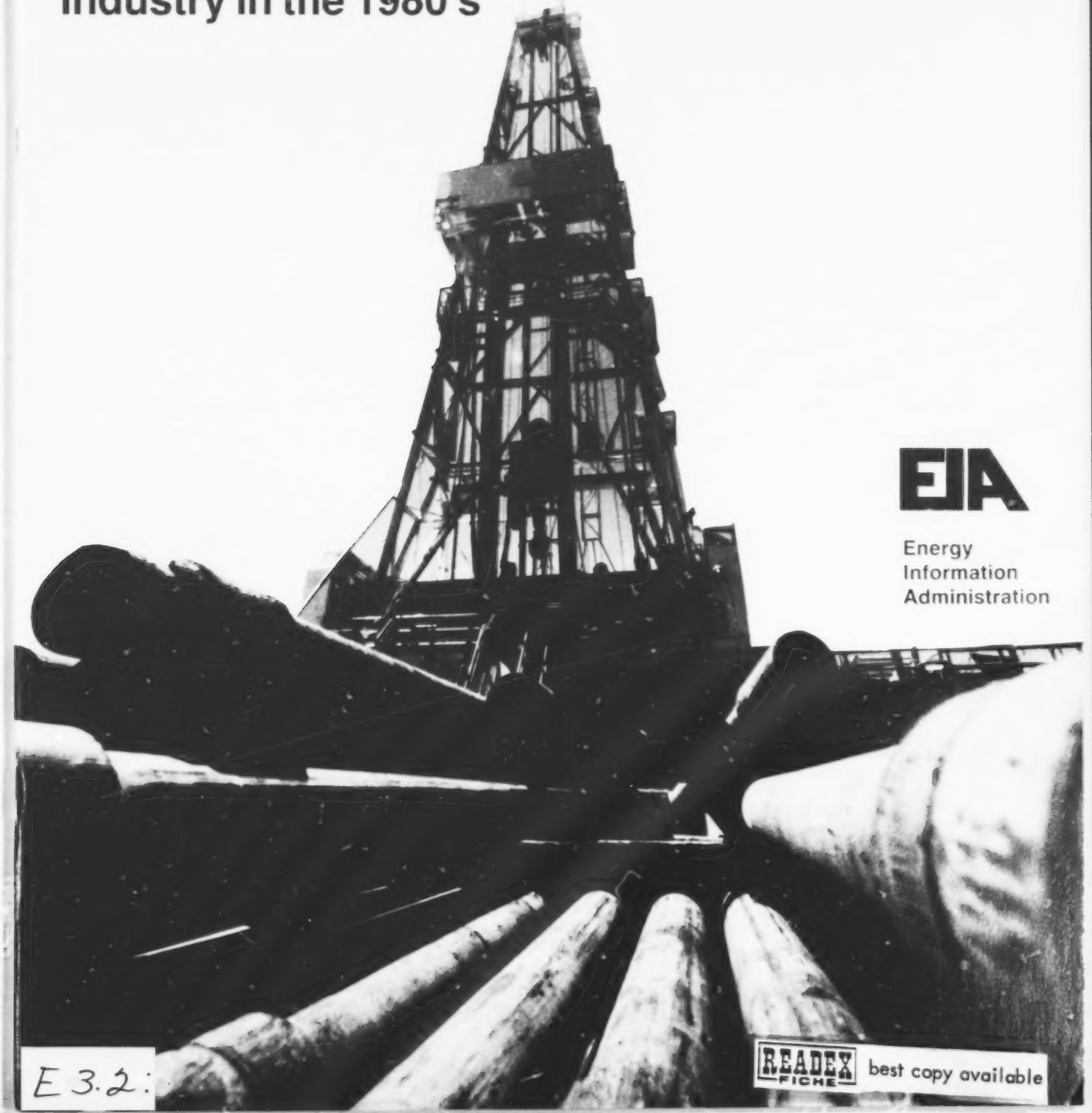
Financial Aspects of the Consolidation of the U.S. Oil and Gas Industry in the 1980's



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Financial Aspects of the Consolidation of the U.S. Oil and Gas Industry in the 1980's

Energy Information Administration
Office of Energy Markets and End Use
U.S. Department of Energy
Washington, DC 20585

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Preface

Financial Aspects of the Consolidation of the U.S. Oil and Gas Industry in the 1980's provides an analysis of the consolidation of the domestic oil and gas industry both by mergers and direct purchases of reserves during the 1980's. The analysis employs a variety of economic, financial, and petroleum industry concepts and utilizes statistical tests of hypotheses. The report serves the objective of the Energy Information Administration (EIA) of providing timely analyses of important developments in the energy industry. The analysis includes 22 major energy producers that are included in the EIA's Financial Reporting System and over 200 independent oil and gas producers that were included in publicly available data bases. The report is intended for use by the Congress, Government agencies, industry analysts, and the public.

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Executive Summary

The U.S. oil and gas industry has made adjustments to the decline in oil prices in the 1980's. These adjustments include the reduction of exploration and development activity, the exiting of companies from the market, and the consolidation of the control of oil and gas reserves by the surviving companies.

During the consolidation of the U.S. oil and gas industry in the 1980's, purchases of reserves became prominent as a means of replacing oil and gas production among surviving companies. For the 1982 through 1986 period purchases of proved reserves accounted for 35 percent of U.S. oil and gas reserve additions by the 22 major petroleum companies (and nearly 40 percent for independent and major companies combined.) By contrast, over the 5-year period 1977 through 1981, only 12 percent of reserve additions by the majors were gained through purchases. (Data for the independents for 1977 through 1981 are not available.)

For the 1982 through 1986 period of declining oil prices, surviving companies tended to fall into two distinct groups: those that depended heavily on reserve purchases to augment their U.S. oil and gas reserves (the high purchase group), and those that relied largely on their own exploration and development efforts to replace their U.S. oil and gas production (the low purchase group)(Table ES1).

This study investigates economic factors associated with the consolidation of the U.S. oil and gas industry by comparing the characteristics and performance of the high purchase and low purchase groups of companies. Two alternative hypotheses are considered as possible explanations of the driving force for the consolidation.

The first hypothesis is based on a "make-or-buy" decision in which companies with relatively high costs for adding oil and gas reserves by their own exploration and development efforts would tend to rely heavily on purchases of reserves to replace their production. The analysis found strong evidence to support this hypothesis:

- High purchase companies tended to have higher costs of finding U. S. oil and gas reserves than companies that depended less on purchases to replace their production. Average finding costs for the high purchase group among majors were from 30 to 63 percent higher than for the low purchase group, depending on the cost measure examined. For independents, costs for the high purchase group were 28 to 37 percent higher.

- Over the 1982 through 1986 period, the gap in finding costs between the high and low purchase groups narrowed sharply, as did the difference between finding costs and reserve purchase costs. By 1987, reserve purchases became less important as a source of reserve additions, with the high purchase group having the greatest reduction in dependence upon reserve purchases.

The second hypothesis is based on a "market for corporate control" model that holds that takeovers and mergers are generally the result of efficient managements displacing inefficient managements through purchase of the target companies' common stock. This hypothesis implies that companies acquiring other companies were both more efficient and more highly valued by investors than the takeover targets. A number of comparisons between acquiring and acquired companies, and between the high purchase and low purchase groups were made, including measures of finding costs, investor valuation, and profitability. No evidence was found to indicate that the market for corporate control model was relevant to understanding the consolidation of the U. S. oil and gas industry in the 1980's. It should be emphasized, however, that the findings of this paper do not constitute a general test of the market for corporate control model since it could be relevant for industries other than the U.S. oil and gas industry.

Table ES1. Percent of Reserves Purchased and Reserve Purchases as a Percent of Exploration and Development Expenditures, 1982-1986

Ratio	22 Majors		202 Independents	
	High Purchase Group	Low Purchase Group	High Purchase Group	Low Purchase Group
Purchased Reserves as Percent of Total Reserve Additions	65	12	67	14
Reserve Purchases as Percent of Exploration and Development Expenditures	46	6	45	8

Source: 22 major petroleum companies: Energy Information Administration, Form EIA-28. 202 independent oil and gas producers: Arthur Andersen and Co., *Oil and Gas Reserves Disclosures*, 1985 and 1986 editions.

1. Introduction

The period of declining oil prices, which began in 1981, has led to a consolidation of the U.S. oil and gas industry. Prominent among the reactions to falling oil prices have been changes in U.S. exploration and development strategies, a substantial reduction in U.S. exploration and development activity, the exiting of many companies from the industry, and consolidation of oil and gas assets among the remaining companies. The growing role of purchases of proved reserves in the exploration and development strategies of surviving oil and gas producers has become particularly evident. Among the 22 major petroleum companies included in this study (the data are described in the next section), purchases of reserves accounted for 35 percent of their oil and gas reserve additions over the 1982 through 1986 period. During the previous 5-year period, only 12 percent of added reserves came through purchases for the same companies. For the 202 independent oil and gas producers, reserve purchases accounted for 37 percent of their U.S. reserve additions from 1982 through 1986 (data for the prior 5 years are not available).

In this paper, an attempt is made to gain further understanding of the process and consequences of consolidation of the U.S. oil and gas industry. Of particular interest are the economic motivations for shifting resource development strategies toward greater reliance on purchases of existing reserves. Two paradigms are explored: the "market for corporate control" and the "make-or-buy" decision.

The market for corporate control has gained acceptance as an explanation for the wave of takeovers and mergers in U.S. industry in the 1980's. (A detailed discussion of this model may be found in subsequent sections.) In brief, this view envisions a process in which more efficient management replaces less efficient management by takeovers effected through the purchase of common stock.

Within the oil and gas industry there have been major takeovers and subsequent mergers in the 1980's. Among the 22 major petroleum companies, five major takeovers[1] accounted for 64 percent of the major companies' reserve purchases over the 1982 through 1986 period. Three other mergers in which major petroleum companies gained prominence in the natural gas transmission sector[2] accounted for an additional 8 percent of the major petroleum companies' reserve purchases over the same period.

This apparent increased reliance on reserve purchases to replace production might be simply a consequence of the workings of the market for corporate control. However, there may be additional factors to be considered. First, takeovers do not fully account for the magnitude of reserve purchases. Property purchases and acquisition of oil and gas subsidiaries which did not involve takeovers were much more numerous as means of gaining proved reserves. Second, the primary objective of most takeovers in the oil and gas industry appears to have been the gain of significant amounts of oil and gas reserves, particularly in the United States. Takeovers may have been the vehicles by which reserves were acquired. Third, among the independent oil and gas producers, takeovers were less prominent as a means of gaining additional reserves, yet surviving independents relied on reserve purchases to nearly the same extent as did the majors during the period of declining oil prices.

A second model, rooted in the concept of the make-or-buy decision, is evaluated as an alternative explanation of the economic basis for the consolidation of the oil and gas industry. Briefly stated, the make-or-buy hypothesis holds that, at the margin, a company will purchase a product rather than produce the good in question within the company if the additional costs of in-house manufacturing exceeds the cost of purchase. In the case of oil and gas reserves, a company will tend to purchase existing reserves to replace its production if the costs of finding and developing new reserves exceed the cost of purchasing reserves.

The methodology employed to ascertain the economic motivations underlying the consolidation of the oil and gas industry is straightforward. Measures of relevant characteristics of publicly traded oil and gas producers grouped by differing resource development strategies are compared and evaluated in light of the empirical implications of the market for corporate control model and the make-or-buy model. The analysis is conducted in the context of all reserve purchases, whether by takeover or otherwise. Additionally, the empirical implications of the two models are given further scrutiny in the context

[1] In 1982, Occidental acquired Cities Service. In 1984, the mergers were Chevron-Gulf Oil, Mobil-Superior Oil, and Texaco-Getty. In 1986, USX acquired TXO.

[2] These mergers were Burlington Northern-El Paso, Coastal-American Natural Resources, and Occidental-MidCon.

of characteristics of companies involved in mergers within the oil and gas industry.

The organization of the paper assumes the following order. The data and methodology are dealt with in the next section. Since the motivations for differing resource development strategies are related to resource development performance, U.S. exploration and development results for the company groups are examined. Then, implications of the two models are examined in the context of the corporate disclosures of financial and operating data of oil and gas producers. Further examination of the results is made in the context of mergers and takeovers in the oil and gas industry during the 1980's; and, lastly, the implications of the findings for the course of U.S. oil and gas resource development are assessed.

2. Data Sources and Methodology

To evaluate the characteristics, motivations, and results of reserve purchase strategies, the results were examined for the 22 major energy companies and over 200 independent producers for the 1982 through 1986 period (a period of generally declining oil prices). The study focuses on the period from 1982 through 1986. As evidenced by the growth in reserve purchases (Figure 1), 1982 can be marked as the onset of the consolidation of the U.S. oil and gas industry. Further, by 1987, the pace of industry consolidation fell considerably and the differences between the high and low purchase groups became negligible in that year for reasons that are discussed in this report. The data for the major petroleum companies were taken from the Energy Information Administration's Financial Reporting System (FRS) which is derived from Form EIA-28. The data for the independent producers were obtained from the Arthur Andersen & Co. reserve disclosure data base.[3]

The latter data base was screened to exclude companies with apparent reporting inconsistencies. For example, companies that reported a material amount of physical reserve purchases but no dollar value for acquisitions of proved reserves were deleted. As a result, 202 independent oil and gas producers were included in the study.[4] The 224 companies are a diverse group with respect to a variety of characteristics. Many are highly specialized in oil and gas production, while others have substantial downstream asset commitments and non-energy operations. Many of the independents' oil and gas operations are essentially located within the United States, but a majority of the major petroleum companies also are involved in foreign oil and gas production. Despite the diversity of characteristics across companies included in this analysis, distinguishing the companies on the basis of their reliance on purchases of proved U.S. reserves is straightforward.

To focus on reserve purchases as an element of exploration and development strategy, the ratio of U.S. oil and gas reserve purchases (on a crude oil equivalent basis) to total U.S. oil and gas reserve additions (including purchases) for the 1982 through 1986 period was computed for each company. The 22 major petroleum companies and the 202 independent oil and gas producers were analyzed separately since patterns of resource development strategy and results are distinctive between the majors and the independents.[5] Within each category, companies exceeding the average purchase ratio were classified into the "high purchase group" and companies with a reserve purchase ratio below the average were classified into the "low purchase group."

For the majors the separation was quite clear. The reserve purchase ratio for the high purchase group (9 companies) ranged from 40 to 91 percent while for the low purchase group (13 companies) the range was 0 to 31 percent. (The companies in each group are listed in the Appendix.) The groups differed substantially in their utilization of reserve purchases during the period of declining oil prices (Table 1).[6] The nine majors in the high purchase group obtained nearly two-thirds of their U.S. reserve additions through purchases of reserves via mergers and acquisitions of producing properties and companies. The 13 other majors relied on reserve purchases for only 12 percent of their U.S. oil and gas reserve additions. The

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[3]The FRS data are published annually by the Energy Information Administration. The most recent issue is Energy Information Administration, *Performance Profiles of Major Energy Producers 1987*, DOE/EIA-0206(87)(Washington, DC, January 1989). The Arthur Andersen data are also published annually. The most recent issue is Arthur Andersen & Co., *Oil & Gas Reserve Disclosures: 1983-1987 Survey of 270 Public Companies*, (Chicago, IL, 1988). Corporate financial data for this latter group were obtained from Securities and Exchange Commission Form 10-K contained on the Standard & Poors, Inc., *Compustat II* data base.

[4]Our initial screen included only those companies that reported usable data for 5 consecutive years ending in 1986. However, this resulted in artificial truncation of the number of observations due to the reduced number of companies that Arthur Andersen & Co. included in their 1986 survey. Note that the omitted companies did not necessarily exit the industry. Rather, Arthur Andersen & Co. excluded them as an economy measure. These considerations led us to also include in the study group those companies that were not included in 1986 but had reported usable data for 5 consecutive years ending in 1985. There were 136 companies in the 1982-1986 group and 66 companies in the 1981-1985 group. Generally, the companies that Arthur Andersen & Co. deleted from their 1986 compilation were relatively small. They accounted for less than 2 percent of total oil and gas output of the 202 companies. The data were standardized on T=1 to 5 with exploration and development cost data expressed in constant 1987 dollars. Thus, unless otherwise noted a reference to "1986" actually refers to T=5.

[5]In 1986 for example, the majors drilled less than 19 percent of total U.S. wells, but accounted for 34 percent of total reserve additions. Calculated from data in *Performance Profiles of Major Energy Producers 1987*, DOE/EIA-0206(87)(Washington, DC, January 1989), pp. 53, 59.

[6]Most of the data used in this study are weighted averages over the 1982 through 1986 period. However, the tables also present data for 1982 and 1986 to give indications of the trends over the period.

Table 1. Reserve Purchase Ratios, Distribution of Expenditures, and Average U.S. Oil and Gas Reserves of 22 Major Petroleum Companies and 202 Independent Producers, 1982-1986

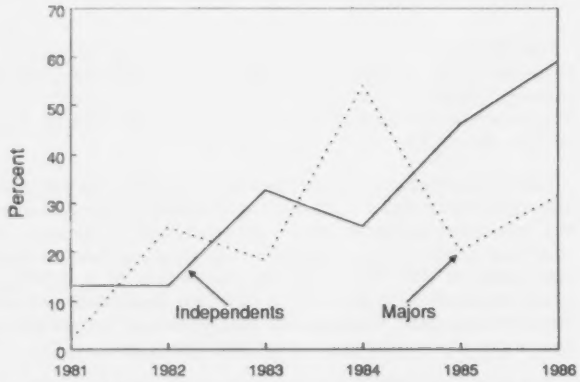
Purchases, Distribution of Expenditures, and Average Reserves	22 Majors [a]		202 Independents [b]	
	High Purchase Group (9 Companies)	Low Purchase Group (13 Companies)	High Purchase Group (80 Companies)	Low Purchase Group (122 Companies)
	(percent)			
Reserve Purchase Ratio, 1982-1986[c] (percent)	64.9	12.1	67.1	14.2
Distribution of U.S. Exploration and Development Expenditures, 1982-1986				
Reserve Purchases[d]	46.1	5.7	44.7	8.4
Exploration (Including Unproved Acreage)	28.2	44.5	31.8	51.1
Development	25.7	49.7	23.5	40.4
Total	100.0	100.0	100.0	100.0
	(million barrels, COE, per Company [e])			
Average U.S. Oil and Gas Reserves				
1982	1,014.0	2,092.2	7.9	20.3
1986	1,385.6	2,016.0	14.3	21.5

[a]The 22 majors are Financial Reporting System companies that were not acquired during the study period.
[b]The 202 independent oil and gas producers are those with 5 consecutive years of usable data.
[c]Reserve Purchase Ratio = 100 x reserve purchases/(reserve additions + reserve purchases). Reserve additions exclude ARCO's downward revision of Alaskan natural gas reserves of 8.3 trillion cubic feet in 1985.
[d]Expenditures for acquisition of proved acreage.
[e]COE = crude oil equivalent. Dry natural gas was converted at 0.177 barrels of crude oil per 1,000 cubic feet for 1982 and 0.178 barrels for 1983 through 1986.
Note: Components may not sum to total due to independent rounding.
Sources: 22 major petroleum companies: Energy Information Administration, Form EIA-28. 202 independent oil and gas producers: Arthur Andersen and Co., *Oil and Gas Reserves Disclosures*, 1985 and 1986 editions (Chicago, IL, 1986 and 1987).

high and low purchase groups' results for the 202 independent oil and gas producers are strikingly similar to the majors' high and low purchase groups. The 80 independent companies classified into the high purchase group gained 67 percent of their reserve additions through purchases but only 14 percent of the other 122 producers' reserve additions came through purchases. The pattern of purchase ratios for the groups is shown in Figure 1.

The differences in strategy are apparent in the companies' expenditure patterns as well. The high purchase companies among both the majors and independents allocated well in excess of 40 percent of their exploration and development expenditures to the purchase of proved reserves. By contrast, companies that relied on their own efforts to find and develop oil and gas supplies expended less than 10 percent of their exploration and development budgets for reserve purchases.

Figure 1. Reserve Purchase Ratios



Sources: 22 Major petroleum companies: Energy Information Administration, *Performance Profiles of Major Energy Producers 1987*, DOE/EIA-0206(87) (Washington, DC, January 1989) and Form EIA-28. 202 Independents: Arthur Andersen & Co., *Oil and Gas Reserve Disclosures*, 1985, 1986, and 1987 editions (Chicago, IL, 1986, 1987, 1988).

There are two important aspects of the last two lines of Table 1. First, at the onset of the decline in oil prices, the companies that subsequently emphasized a strategy of reserve purchase were much smaller, on average, in terms of holdings of U.S. oil and gas reserves. Among the majors, the high purchase group's net ownership of U.S. oil and gas reserves averaged about half of the amount of the other majors at the beginning of 1982. Among the independents, the contrast was greater, with the high purchase group holding, on average, only about 40 percent of the reserves held by the other companies. Second, by the end of 1986, the high purchase companies had effected a much greater improvement in their U.S. oil and gas position. Among the majors, U.S. reserves grew by nearly 40 percent over the period for the high purchase group and nearly doubled for the high purchase group of independents. The U.S. reserves of the other majors declined slightly and were up less than 5 percent for the other independents. Clearly, differing strategies yielded differences in results.

3. Exploration and Development Results

We next turn to a review of differences in results, and through further examination of the characteristics of the groups, we attempt to ascertain the motives for differing strategies. The higher rate of reserve growth of the high purchase group over the 1982 through 1986 span suggested by the last two lines of Table 1 is fully evident in Table 2. Accordingly, the differential growth in reserves was reflected in substantial growth in production for the high purchase companies while for the other companies, production declined somewhat between 1982 and 1986. The reserves added by companies that followed a strategy of reliance on reserve purchases exceeded, by a substantial margin, their production over the 1982 through 1986 period. Among the major petroleum companies, the U.S. oil and gas reserve additions (including purchases) of the 9 high purchase companies outstripped production by 61 percent and, for the 80 independent producers classified into the high purchase group, reserve additions were nearly triple their production. For the low purchase group of majors, oil and gas reserve additions, on balance, just matched production, while for the low purchase group of independents natural gas reserve additions were 35 percent above production and oil reserve additions and production were nearly equal.

The resource development performance, in physical dimensions, of the majors that pursued a strategy of reserve acquisition in the 1980's was a reversal of their performance prior to 1982. Table 3 provides data for the two groups of major petroleum companies for the period 1976 through 1981.[7] Until the first quarter of 1981, crude oil price controls were in effect during this period in the United States. The price controls served to keep U.S. wellhead prices below the level of world oil prices, thereby reducing the incentives for U.S. oil and gas resource development. Major petroleum companies tended to be more adversely affected by price controls than other petroleum companies. Over the 1977 through 1981 period, the 22 surviving FRS respondents replaced only 63 percent of their U.S. oil and gas production through reserve additions, including reserve purchases.[8] For the United States in total, 82 percent of oil and gas production was replaced over the same period.[9] By the end of that period, the nine high purchase companies were in a severely deteriorating domestic reserve position. Their combined domestic oil and gas reserves had fallen by 30 percent between the beginning of 1977 and the end of 1981. This group's share of production also was slipping rapidly. Their combined domestic oil and gas production was down 20 percent between 1976 and 1981. Over the 1977 through 1981 period, only 26 percent of their production was replaced through additions to reserves (including purchases of reserves). Clearly, strategies had to change to reverse this rapid deterioration. In contrast, the 13 companies composing the low purchase group exhibited a considerably better performance in the 1977 through 1981 period. Their domestic reserves of oil and gas declined by a comparatively slight 6 percent between the beginning of 1977 and the end of 1981, while their combined domestic production of oil and gas increased by 5 percent between 1976 and 1981. Although this group did not fully replace their oil and gas production over the period, their replacement ratio of 81 percent was better than the rest of the industry, particularly compared to the other major companies.

The impetus for a divergence in resource development strategies was evident in the contrast in performance over the 1977 through 1981 period. During this period, there was not much difference in the use of reserve purchases as a method of adding oil and gas reserves. Purchases over this period accounted for less than 15 percent of the major companies' reserve additions. Given the oil price expectations of the early part of this decade, the refinery requirements of most of the majors, and long-term natural gas supply obligations of many of the majors as well as independents, the pressure to reverse the poor showing in U.S. oil and gas resource development was substantial. However, the basis for the divergent strategies followed in the 1980's is not evident until financial and economic factors are brought into the analysis.

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[7] Data were not available for a similar analysis of the independents.

[8] Based on data from Energy Information Administration, Form EIA-28.

[9] Calculated from Energy Information Administration, *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves*, 1987 Annual Report, DOE/EIA-0216(87) (Washington, DC, October 1988), except for natural gas liquids for 1977 and 1978, data for which were obtained from American Gas Association, American Petroleum Institute, and Canadian Petroleum Association (published jointly), *Reserves of Crude Oil, Natural Gas Liquids and Natural Gas in the United States and Canada as of December 31, 1979* (Washington, DC June 1980).

Table 2. Measures of U.S. Oil and Gas Resource Development Performance for 22 Major Petroleum Companies and 202 Independent Producers, 1982-1986

Measures	22 Majors [a]		202 Independents [b]	
	High Purchase Group (9 Companies)	Low Purchase Group (13 Companies)	High Purchase Group (80 Companies)	Low Purchase Group (122 Companies)
	(percent)			
Annual Growth in U.S. Reserves, 1982-1986				
Oil	6.1	-0.8	14.9	-3.8
Natural Gas	5.7	0.2	15.3	2.6
Total	6.0	-0.3	15.1	0.9
Annual Growth in U.S. Production, 1982-1986				
Oil	10.2	0.8	11.0	-1.4
Natural Gas	6.2	-2.7	8.9	-1.6
Total	8.4	-0.4	9.7	-1.5
U.S. Production Replacement Ratio[c], 1982-1986 (percent)				
Oil	157.2	95.8	260.4	99.3
Natural Gas	164.8	110.1	277.7	134.6
Total	160.6	100.9	270.8	122.9
Share of U.S. Oil and Gas Production				
1982	13.2	30.9	1.4	5.3
1986	19.1	31.8	2.3	5.1

[a]The 22 majors are Financial Reporting System companies that were not acquired during the study period.
[b]The 202 independent oil and gas producers are those with 5 consecutive years of usable data.
[c]Production replacement ratio = 100 x total reserve additions (including purchases) / production.
Source: 22 major petroleum companies: Energy Information Administration, Form EIA-28. 202 independent oil and gas producers: Arthur Andersen and Co., *Oil and Gas Reserves Disclosures*, 1985 and 1986 editions. U.S. total oil production and natural gas production: Energy Information Administration, *Monthly Energy Review* February 1988, DOE/EIA-0035(88/02) (Washington, DC, May 1988), pp. 36, 56.

Table 3. Measures of U.S. Oil and Gas Resource Development Performance and Costs for 22 Major Petroleum Companies, 1976-1981

Performance and Cost Measures	High Purchase Group (9 Companies)	Low Purchase Group (13 Companies)
	(percent)	
Growth in Reserves, 1976-1981	-29.7	-5.8
Growth in Production, 1976-1981	-19.8	4.9
Production Replacement Ratio, 1977-1981 (percent)	26.3	80.5
Reserve Purchase Ratio, 1977 through 1981 (percent)	14.4	11.6
	(1987 dollars per barrel, COE)[b]	
Total Finding Costs, 1977-1981[a]	29.09	9.99

[a]Exploration and development expenditures, excluding expenditures for acquisition of proved acreage, divided by reserve additions, excluding purchases of reserves.
[b]COE = crude oil equivalent. Dry natural gas was converted at 0.177 barrels of crude oil per 1,000 cubic feet.
Source: Energy Information Administration, Form EIA-28.

4. The Make or Buy Decision

Finding costs are an estimate of a company's average cost to increase its proved reserves and usually are expressed on a per-barrel basis. The costs included in this calculation are current expenditures for drilling and equipping wells, unproved lease acquisition costs, and support equipment and overhead expenditures. Reserves may be added by exploratory or development efforts. A comprehensive measure of finding costs would be the total of these expenditures in a given time period divided by the total reserve additions (excluding acquisitions) during the same period. A measure that excludes revisions from the calculation of reserve additions and one that relates exploration expenditures to reserves added by exploratory efforts (i.e., reserve extensions and discoveries) are also used in this report. In all instances, these are weighted average costs and should not be confused with marginal costs.[10]

An important line of inquiry is suggested by the data in the last line of Table 3. For the majors, a conventional measure of finding costs[11] was nearly three times as great for the high purchase companies as for the low purchase companies over the 1977 through 1981 period, and exceeded the average crude oil price of $23.65 per barrel (1987 dollars). Viewing the exploration and development allocation decision in the context of the make or buy decision provides a straightforward explanation of the divergence of strategies: companies with relatively high finding costs frequently opted to purchase producing properties and therefore reduced their own efforts to find and develop additional reserves. On the other hand, companies with relatively low finding costs emphasized the utilization of their own in-house capabilities to replace their oil and gas production. Of course, the exploration and development decision is much more complex than a simple binary choice problem. Oil and gas producers, particularly the larger ones, have a portfolio of oil and gas prospects. Also, companies have made considerable investments in gaining and keeping their explorationists, geologists, and other resource development personnel and capabilities. Consequently, few, if any, companies would have been led to depend wholly on purchases for their exploration and development programs.

The incentive for some companies to emphasize purchases over in-house efforts was apparent for the 1977 through 1981 period in that some companies had much higher finding costs than others. Yet, as shown in Table 3, purchase of reserves was a relatively minor component of resource development strategy among the majors. Not until 1982 did reserve purchases begin to show an increased prominence (Figure 1).

The decision-making environment was affected by at least four developments. First, oil prices and oil price expectations were rising from 1974 through early 1981. Consequently, the reservation prices of oil and gas producers (i.e., the price at which producers were indifferent between sale or retention of properties) were also rising. The oil price peak of 1981 led to downward revisions of price expectations and, given the uncertainties occasioned by the break in the Organization of Petroleum Exporting Countries' (OPEC) pricing, a greater dispersion of price expectations and reservation prices was generated. Further, lower prices reduced the expected profitability of exploration and development but not the inherent associated risk. Thus, to maintain the same overall level of risk for their entire investment portfolio required shifting to less risky investments, such as reserve purchases. Second, beginning in 1982, a relaxed view of mergers and acquisitions by antitrust authorities reduced the restraints on mergers between oil and gas producers, particularly the integrated major petroleum companies.[12] Third, innovations in the financial markets, such as junk bond financing, made financing of mergers and takeovers on an unprecedented scale possible. Fourth, a great amount of debt and other forms of external financing were incurred by many independent oil and gas producers during the price escalation

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[10]Precise measurement of finding costs is complicated by lags between expenditures and associated reserve additions. For a detailed discussion of finding cost measurement, see Arthur Andersen and Co., *Oil and Gas Reserve Disclosures* (Chicago, IL, 1988), pp. S-32 through S-35.

[11]Exploration and development expenditures, excluding expenditures for acquisition of proved acreage, divided by reserve additions, excluding purchases of reserves.

[12]For example, the Antitrust Division of the U.S. Department of Justice submitted congressional testimony in 1984, which stated, in part, that "No recent oil company merger that has been consummated threatens competition or the exploration for, or production of, crude oil...." U.S. Congress, Senate Committee on Energy and Natural Resources, *Legislation Affecting Oil Merger Proposals: Hearing on S. 2362*, 98th Cong., 2d Sess., April 10, 1984, p. 54.

Table 4. Finding Costs and Reserve Purchase Costs for 22 Major Petroleum Companies and 202 Independent Producers, 1982-1986

Cost Category	22 Majors [a]		202 Independents [b]	
	High Purchase Group (9 Companies)	Low Purchase Group (13 Companies)	High Purchase Group (80 Companies)	Low Purchase Group (122 Companies)
	(1987 dollars per barrel)			
Exploratory Finding Costs[c]				
1982	18.35	9.46	14.04	9.75
1986	8.99	5.86	4.48	3.75
1982 through 1986 Average	13.12	8.07	9.55	7.24
Total Finding Costs[d]				
1982	20.52	12.74	22.27	16.08
1986	7.68	9.89	12.81	9.05
1982 through 1986 Average	12.48	9.59	14.98	10.92
Total Finding Costs Excluding Revisions				
1982	27.67	17.61	22.40	16.39
1986	13.54	9.78	10.19	7.29
1982 through 1986 Average	17.10	12.31	15.70	12.29
Reserve Purchase Costs (Both Groups)[e]				
1982	9.54		8.37	
1986	3.92		5.04	
1982 through 1986 Average	5.49		5.96	

[a]The 22 majors are Financial Reporting System companies that were not acquired during the study period.
[b]The 202 independent oil and gas producers are those with 5 consecutive years of usable data.
[c]Exploratory findings costs equal unproved acreage acquisition expenditures plus exploration expenditures divided by extensions and discoveries.
[d]Total finding costs equal unproved acreage expenditures plus exploration expenditures plus development expenditures divided by oil and gas reserve additions (i.e., revisions, improved recovery, plus extensions and discoveries).
[e]Reserve purchase costs equal expenditures for proved acreage divided by purchases of minerals-in-place.
Note: All averages are weighted averages.
Source: 22 Major petroleum companies: Energy Information Administration, Form EIA-28. 202 independent oil and gas producers: Arthur Andersen & Co., *Oil and Gas Reserves Disclosures*, 1985, 1986 and 1987 editions (Chicago, IL, 1986, 1987 and 1988).

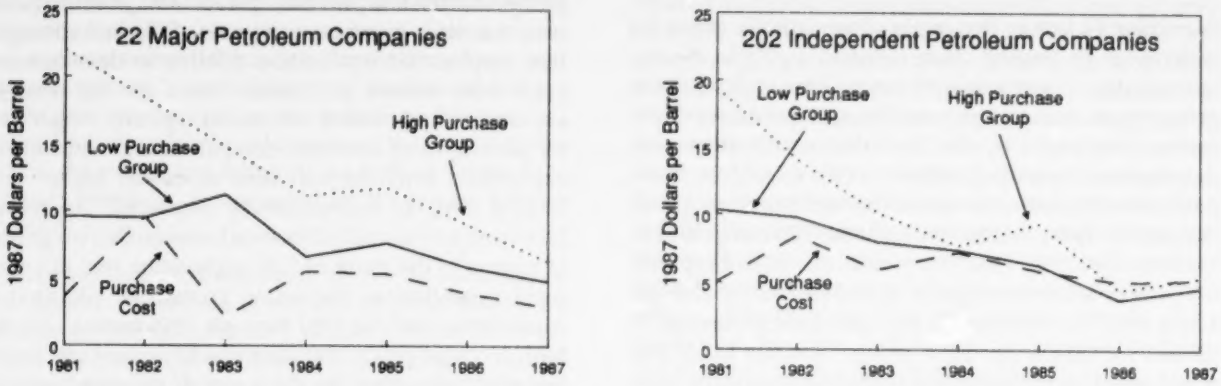
of 1979 through 1981. As oil prices dropped, some producers had to sell producing properties in order to cover debt obligations.

Support for the view that a make-or-buy decision process, at least in part, underlaid the divergence in resource development strategies is presented in Table 4. Various commonly reported measures of finding costs were computed, as well as the per-barrel cost of purchased reserves. We focus on exploratory finding costs, since the cost of effecting discoveries and extensions is probably most relevant in the make-or-buy context. However, by any measure, our conclusions remain the same.

Among the majors, exploratory finding costs were nearly $5 per-barrel higher over the 1982 through 1986 period for the high purchase companies.[13] Over that period, the differential narrowed from well over $8 per barrel to about $3 per barrel. The fact that finding costs declined over that period is hardly surprising, since a large amount

[13]In this study we have attempted to capture the population of publicly traded oil and gas producer that have survived the period of declining oil prices. We have divided this population into subpopulations based on the characteristics of relative use of reserve purchases to replace oil and gas production. Thus, the averages shown in Table 4 are population, not sample, values and our inferences concerning differences in finding costs should not be encumbered by problems of sample variances. Nevertheless, for readers who might believe that conventional tests of differences between means are useful in this context, the t-ratios for the differences in the 1982 through 1986 averages presented in Table 4 were calculated. Except for the total finding cost measure for the majors, the differences between the high and low purchase groups were statistically significant at the 0.025 level or better. The difference for the majors' total finding was statistically significant at the 0.11 level.

Figure 2. Reserve Purchase Costs and Exploratory Finding Costs for High and Low Purchase Groups



Sources: 22 Major petroleum companies: Energy Information Administration, *Performance Profiles of Major Energy Producers 1987*, DOE/EIA-0206(87) (Washington, DC, January 1989) and Form EIA-28. 202 Independents: Arthur Andersen & Co., *Oil and Gas Reserve Disclosures*, 1985, 1986, and 1987 editions (Chicago, IL, 1986, 1987, 1988).

of overcapacity in the oilfield services sector resulted when drilling followed the downward path of oil prices. The decline in the differential suggests that the high purchase companies eliminated a substantial amount of high-cost projects from exploration and development portfolios as purchases were substituted for in-house efforts and that, in acquiring reserves and expertise of the acquired company by mergers and acquisitions, lower finding costs may have been achieved. (This second point is examined in the section on the role of mergers.)

Similar, but less pronounced, results are evident for the independents. Exploratory finding costs averaged over $2 per barrel more for the high purchase group over 1982 through 1986. The differential narrowed from $4 in 1982 to less than $1 per barrel in 1986 (Figure 2).

Despite some data limitations,[14] data shown in Table 4 clearly indicate that differences in finding costs were a contributing factor to differences in strategy among oil and gas producers during the period of declining oil prices. Additional support is gained by the regression[15] of the reserve purchase ratio for 1982 through 1986 on exploratory finding costs for the 22 majors:

$$\text{Purchase Ratio} = 4.47 + 2.19\ (\text{Finding Cost}).$$

[14]Over the period, exploratory finding costs tended to exceed reserve purchase costs. However, the difference is overstated due to a number of factors which cannot be corrected because of data limitations. First, the measures shown in Table 4 are on a pretax basis but investment decisions are made on an after-tax basis. Calculating finding costs on an after-tax basis is relatively straightforward. After-tax reserve purchase costs are much more difficult to calculate. Since a large share of reserve purchases were effected through mergers and acquisitions, the after-tax costs depend on the tax positions of the acquiring and acquired companies. Further, mergers entail complex tax planning strategies to reduce tax liabilities. Consequently, it is not possible to obtain an accurate after-tax measure of reserve purchase costs.

However, oil and gas exploration and development expenditures are favored with specific tax breaks; in particular, intangible drilling costs, which generally can be expensed, constitute about 70 percent of exploration and development expenditures. In contrast, a property acquisition, apart from the tax planning opportunities gained through merger, is generally not favored with special tax benefits and typically is not eligible for the investment tax credit. In general, we would expect that the differential between finding costs and purchase costs would be considerably less on an after-tax basis. Second, the dollar value of acquisitions of proved acreage only includes the increment to the property, plant, and equipment account of the balance sheet. In effecting a reserve purchase, particularly by merger, many categories of costs that are incurred are reflected elsewhere in the company's accounts. Examples include litigation, costs of obtaining large-scale financing, assumption of acquired company liabilities, and effects on working capital which add to the costs of reserve acquisitions but are not included in the measure of reserve purchase cost available for this study. If the full cost of reserve purchases were used, then the differential between it and finding cost measures would be further narrowed.

[15]Regression analysis is the subject of numerous textbooks. See, for example, Harry H. Kelejian and Wallace E. Oates, *Introduction to Econometrics: Principles and Applications* (New York: Harper & Row, 1974).

The t-ratio of 1.96 on the finding cost variable coefficient indicates that it is significantly greater than zero at the 0.06 level.[16]

A number of factors that might systematically affect the differences in finding costs reported in Table 4 were investigated. The relative efficiency of the high purchase group in purchasing as opposed to exploration activity is further indicated by the fact that exploration and development spending, relative to the size of the company, was 33 percent lower for the high purchase group than for the low purchase group of the FRS companies in 1982 through 1986. Over this period, the ratio of exploration and development spending to domestic oil and gas assets was 18 percent for the high purchase group and 27 percent for the low purchase group. Another factor that might affect the measurement of finding costs is the composition of exploration and development activity between onshore and offshore locales. Finding costs, as conventionally measured, tend to be higher for offshore locales than onshore locales.[17] However, this factor does not appear to have affected the differential in finding costs reported in Table 4 in that the share of U.S. exploration and development expenditures allocated to offshore locales over the 1982 through 1986 period was 28 percent for the high purchase group of major petroleum companies, which was less than the comparable share of 33 percent for the low purchase group. Also, it could be the case that high purchase companies followed strategies that emphasized exploration relative to development, apart from reserve purchases. Since the lag between exploration and booked reserves is typically longer than for development activities, companies that emphasized exploration activities will tend to exhibit higher total finding costs as conventionally measured. However, there was only a small difference between the two groups of majors in the share of U.S. exploration and development expenditures (excluding purchases) allocated to exploration over the 1982 through 1986 period. For the high purchase group, the share was 52 percent and for the low purchase group the share was 47 percent, based on Table 1. For the two groups of independents, the shares were 58 percent and 56 percent for the high and low purchase groups, respectively. Thus, factors that could affect the measurement of finding costs do not appear to have played any role in the differences in finding costs between the high and low purchase groups reported in Table 4.

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[16]The regression used the square root of reserve additions as a generalized least squares adjustment for heteroskedasticity.

[17]For example, see Energy Information Administration, *Performance Profiles of Major Energy Producers 1987*, DOE/EIA-0206(87) (Washington, DC, January 1989), p. 63.

5. Financial Results and The Market for Corporate Control

The preceding results are clearly consistent with the proposition that, in part, the economics of the make or buy decision underlaid the strategies that have been most instrumental in the consolidation of the U.S. oil and gas production sector during the period of declining oil prices. An alternative explanation of the consolidation within the petroleum industry, as well as within U.S. industry generally, is suggested by the market for corporate control.

It is not our intent to extensively review the literature on this subject. However, a number of propositions are relevant for ascertaining the process and motives operative in the consolidation of the U.S. oil and gas industry. For the purpose of brevity but at the risk of oversimplification, we would expect, based on the market for corporate control paradigm, to find that companies that effected mergers and takeovers in the oil and gas industry tended to be (1) more efficient, (2) more profitable, and (3) more highly valued by investors than the acquisition targets. By extension, we might expect companies that emphasized a strategy of reserve purchases, compared to companies that emphasized in-house resource development efforts, to have exhibited these characteristics. Based on the results for finding costs, the first proposition is dubious: companies that strategically emphasized purchases of reserves tended to experience high average costs in effecting reserve additions through their own efforts. However, to more fully assess the role of the market for corporate control, we investigated the financial characteristics of the company groups.

Table 5 presents a variety of measures of financial performance for the company groups over the 1982 through

Table 5. Measures of Financial Performance for 22 Major Petroleum Companies and 202 Independent Producers, 1982-1986

Financial Indicators	22 Majors [a]		202 Independents [b]	
	High Purchase Group (9 Companies)	Low Purchase Group (13 Companies)	High Purchase Group (80 Companies)	Low Purchase Group (122 Companies)
	(percent)			
Return on Equity[c]				
1982	7.8	14.6	8.0	11.9
1986	0.6	8.6	-1.4	-2.2
1982 through 1986 Average	6.9	12.4	5.2	5.3
Cash Flow/Net Assets[d]				
1982	17.3	24.6	12.7	13.9
1986	14.9	20.7	10.4	10.2
1982 through 1986 Average	16.8	23.2	11.9	12.2
Long-Term Debt/Equity				
1982	37.9	38.1	94.3	72.5
1986	79.8	41.5	101.7	76.3
1982 through 1986 Average	62.2	37.2	88.3	67.9
Q-Ratio[e]				
1982	65.5	95.2	98.2	98.0
1986	90.6	123.2	126.3	121.1
1982 through 1986 Average	76.7	109.2	108.1	103.8

[a]The 22 majors are Financial Reporting System companies that were not acquired during the study period.
[b]The 202 independent oil and gas producers are those with 5 consecutive years of usable data.
[c]Return on equity equals 100 x net income divided by stockholders' equity.
[d]Cash flow is measured by funds from operations disclosed in companies' statement of changes in financial position. Net assets is measured by net property, plant, and equipment disclosed in companies' balance sheets.
[e]Q-Ratio equals 100 x value of common stock divided by stockholders' equity. Annual value of common shares was computed by multiplying the number of common shares by the average of the high, low, and close prices for the shares.
Note: All averages are weighted averages.
Source: 22 Major petroleum companies: Energy Information Administration, Form EIA-28 and Securities and Exchange Commission Form 10-K. 202 independent oil and gas producers: Securities and Exchange Commission Form 10-K.

1986 period. We examine the results for the independent oil and gas producers first since, in fact, there was little contrast in financial performance between the high purchase group and the low purchase group. Return on equity (the ratio of net income to stockholders' equity) is an often-used measure of companies' average profitability. Although the low purchase group of independents was somewhat more profitable in 1982, their return on equity fell more steeply so that, on balance, the return on equity for both groups of independents was a bit over 5 percent for the entire 1982 through 1986 period. Net income (the numerator of return on equity) declined not only because of lower margins on oil and gas production operations but also because many independent oil and gas producers were required (by the rules of the Securities and Exchange Commission) to write down the value of oil and gas properties due to lower oil prices and to reflect the writedowns as charges against income. These charges did not require any outlays and were of a noncash nature. Cash flow (i.e., annual funds generated from current operations) was not affected by writedowns and therefore is less likely to overstate the deterioration in earnings than net income. The second measure reported in Table 5 is the ratio of cash flow to the book value of net property, plant, and equipment. This ratio indicates cash generated relative to a company's scale of operations. The value of this ratio for the two groups of independents over the 1982 through 1986 period was nearly equal at about 12 cents for every dollar of cumulative net investment.

The debt position of a company is an important consideration in assessing a company's financial condition. Among the independents, the high purchase group had a noticeably higher debt-equity ratio than the low purchase group. One reason for the difference is that producing properties have a higher proportion of collateral value than exploration projects, making borrowing for property purchases easier than borrowing for internal resource development efforts. Also, takeovers and acquisitions of companies, which are among the methods of reserve purchase, are often effected through the incurrence of relatively large amounts of debt.

The contrasts in financial performance are much stronger between the two groups of majors than between the two groups of independent oil and gas producers. The return on equity was considerably lower for the high purchase group of majors than for the low purchase group in 1982. It reflected a greater decline between 1982 and 1986 for the high purchase group, and for the 1982 through 1986 period overall, it was only about half as great as the return on equity for the low purchase group.

Although the return on equity was clearly lower for the high purchase group of major petroleum companies, this does not necessarily prove that these companies were less profitable in their U.S. oil and gas operations. However, over the 1982 through 1986 period, the return on investment for U.S. oil and gas production operations (net income divided by the sum of net property, plant, and equipment plus investments and advances) was 6.7 percent for the high purchase group compared to 10.4 percent for the low purchase group, which indicates lower profitability in U.S. oil and gas operations for the high purchase group over the period. The return on equity can be affected by the composition of assets relative to liabilities. In particular, companies with relatively high levels of debt will tend to have relatively low values for stockholders' equity (the denominator in the return on equity measure) which, in turn, can yield a high return on equity compared with companies with lower debt-equity ratios. One profitability measure which is essentially unencumbered by differences in debt-equity ratios is the ratio of net income plus interest expense to stockholders' equity plus long-term debt. For the high purchase group of major petroleum companies over the 1982 through 1986 period, this ratio equaled 9.0 percent compared with 12.2 percent for the low purchase group. Among the independent U.S. oil and gas producers, the ratio was 9.1 percent for the high purchase group and 8.2 percent for the low purchase group. The findings based on this alternative profitability measure support the findings based on the return on equity measure.

Similarly, cash flow relative to net assets was less for the high purchase group of majors than for the other majors throughout the 1982 through 1986 period. At the outset of the consolidation of the oil and gas industry, the two groups of majors both had relatively low debt-equity ratios of 38 percent. By comparison, the Standard and Poors' group of 400 industrial companies (S&P 400) had a debt-equity ratio of 42 percent in 1982. However, as the high purchase group pursued a strategy of mergers, acquisitions, and reserve purchases, their debt-equity ratio more than doubled by 1986. The other majors, in contrast, increased their debt-equity ratio by a modest 3 percentage points over the same period to 41 percent which was less than the 46 percent debt-equity ratio for the S&P 400 in 1986.

The comparatively lesser financial performance of the high purchase majors was not wholly attributable to their heavy reliance on purchases to reverse their resource development performance of earlier years. Indeed, their financial performance might be viewed as a symptom of the difficulties of adjusting to falling oil prices in the context of the cumulative effects of their past asset deployment decisions rather than as an effect of a shift in resource development strategy. At one extreme, had the high purchase companies scaled back their resource development efforts (including purchases) sufficiently to produce much more favorable financial ratios, then the deterioration in their U.S. oil and gas position might have continued, or perhaps, accelerated. At the other extreme,

if the general thrust of their resource development strategy had been a continuation of their generally high-cost resource development efforts, then their financial performance might have sunk below their actual performance in the 1982 through 1986 period and probably would have been unacceptable to stockholders and investors generally. Of course, actual financial performance was a product not only of resource development strategies but also of other asset deployment decisions as well.

Investor valuations are often viewed as reflections of the capital market's outlook for the expected profitability of a company. How did investors view the various groups of companies included in this study? Among the majors, a favorable view of the high purchase companies' reserve growth and production replacement during the period of declining oil prices may have offset the unfavorable effects of their lesser performance in terms of profitability and cash flow and their growth in debt load. Among the independents, investors weighed the greater reserve and production growth of the high purchase group against their higher debt-equity ratio. Many additional factors influence investor valuation, and differences between groups of companies cannot wholly be ascribed to the factors considered here. Nevertheless, examination of differences in investor valuation between the company groups is useful in understanding the process of consolidation in the U.S. oil and gas industry.

The most appropriate general measure for assessing investor evaluation of a company is "Tobin's Q."[18] Tobin's Q is computed as the ratio of the market value of a company's equity and debt to the replacement cost of the company's assets. The higher this ratio is, the more bullish investors are on the company's profit prospects. Alternatively, a ratio substantially below 100 percent indicates that, in principle, an investor could purchase the company through stock acquisition, then liquidate the company's debt and sell the company's assets at the assets' replacement cost, thereby accruing a profit. The computational requirements of Tobin's Q include revaluation of company assets to replacement cost which, with well over 200 companies for 5 years in the present study, is well beyond the reach of our efforts. Instead, we offer a computationally feasible measure which captures much of the conceptual basis of Tobin's Q: the ratio of a company's market value of common stock to stockholders' equity. The value of a company's common stock is the market's assessment of the value of ownership of the company while stockholders' equity is the book value[19] of ownership in the company. A company's current share price reflects investor expectations of the future profitability of a company viewed at the time the stock was purchased. Book value is a reflection of the future profitability expected from productive assets at the time the assets were acquired. A falling ratio of market value to book value indicates a downward revision in investors' perceptions of the expected profitability of the enterprise. For brevity, we term this measure the "Q-Ratio."[20] The Q-Ratios for the companies, separated into 22 major petroleum companies and 202 independent oil and gas producers and further categorized into high and low purchase groups, are presented in the last section of Table 5. Attention is focused first on the 202 independents. As was the case with the profitability and cash flow measures, there is little difference between the high and low purchase groups with respect to their Q-Ratio values. In 1982, market values and book values were quite close for both groups of independents. By 1986, market value was somewhat over 20 percent greater than book value for both groups and for the period as a whole the difference in the Q-Ratios was a negligible 4 percentage points. Thus, investors appeared to have viewed the profitability prospects of both groups of independents as more or less equal over the period of falling oil prices.

Among the 22 majors, the contrast in the Q-Ratios is much sharper. For the 13 majors that relied primarily on their own resource development efforts, market value was slightly below book value in 1982, but in 1986, market value exceeded book value by over 20 percent. These results are very similar to the results for the independents. For the nine majors that emphasized reserve purchases

[18] J. Tobin and W.C. Brainard, "Pitfalls in Financial Model Building," *American Economic Review*, May 1968, pp. 99-122. An early application in the industrial organization literature is Eric B. Lindenberg and Stephen A. Ross, "Tobin's Q Ratio and Industrial Organization," *Journal of Business*, January 1981, pp. 1-32.

[19] Book value, which is based on historical costs, and replacement value are likely to differ. Indeed, the extent of the majors' writedowns of refining, non-petroleum energy, and nonenergy assets in recent years suggests that book value tended to exceed replacement value. However, since we are aggregating over many companies for several years, rather than focusing on single companies, we believe that a large portion of the differences between book and replacement value will cancel out.

[20] Perhaps a more descriptive term would be "market valuation ratio." This measure has been used in other merger analyses. Examples include Michael L. Lawriwsky, "Some Tests of the Influence of Control Type on the Market for Corporate Control in Australia," *Journal of Industrial Organization*, March 1984, pp. 277-291; K. G. Palepu, "Predicting Takeover Targets: A Methodological and Empirical Analysis," *Journal of Accounting and Business*, Vol. 8, 1986, pp. 3-35; and Arthur T. Andersen and T. Crawford Honeycutt, "Management Motives for Takeovers in the Petroleum Industry," *Review of Industrial Organization*, August 1987, pp. 1-12.

over in-house efforts to augment U.S. oil and gas reserves, the Q-Ratio was 30 percentage points lower than the Q-Ratio for the other majors in 1982, indicating that the high purchase group's market value was only about two-thirds of their book value. Moreover, the 30 percentage point differential in the Q-Ratios between the two groups was maintained over the 1982 through 1986 period.

Even though tracing the effects of companies' differing U.S. resource development strategies on financial performance and investor evaluations is tenuous, some conclusions can be drawn from the findings presented for the majors. First, companies that emphasized a buy rather than make strategy tended to be relatively inefficient, in terms of cost, in their own resource development efforts. Second, these same companies tended to be less profitable than the majors that emphasized in-house resource development efforts. Third, investors tended to place a lower valuation on the prospects of the high purchase group relative to the low purchase group.

Our results clearly show that expectations based on the market for corporate control receive little support in the U.S. oil and gas industry. However, a strict interpretation of the paradigm limits its application to takeovers rather than reserve purchases, generally. Hence, the role of the market for corporate control is further investigated by comparing the characteristics of acquiring companies and acquired companies in the oil and gas industry. We turn to this latter line of inquiry in the next section.

6. The Role of Mergers

The preceding analysis indicates that buyers tended to be companies with relatively high-cost resource development performance. To further assess this tendency, mergers between oil and gas companies included in the Arthur Andersen & Co. data base during the 1982 through 1986 period were identified. By comparing the finding costs of the buyer and the seller, further examination of the role of finding costs may be obtained.

Additionally, the market for corporate control paradigm implies that companies that are performing well tend to take over those that are performing poorly.[21] The economics of the market for corporate control has become a topic of controversy due to the large number of takeovers, both friendly and hostile, occurring in recent years. Prominent among the causal factors in theories offered by economists is the one that takeovers are the result of poor performance by incumbent management.[22] This theory of merger activity rests on the separation of ownership (i.e., stock owners of publicly traded companies) and control (i.e., the high-level managers of these companies). The separation of ownership and control clearly has substantial benefits, such as limited liability, long life, and specialization. However, such separation also incurs a risk that the actions of the managers are not consistent with the best interests of the owners.[23] This theory implies that companies that are subject to takeover are relatively undervalued by the stock market, and they are relatively undervalued because their performance is inadequate due to managerial factors. At least one author[24] has argued that petroleum companies wasted money on exploration and development activities during the 1980's, which provided further impetus for takeovers. Mergers and takeovers among oil and gas producers have created substantial debate about the merits of takeovers in general and in particular in the petroleum industry. The Council of Economic Advisers has estimated that mergers and acquisitions in the oil and gas industry were valued at $44.2 billion in the 1981 through 1983 period.[25] A more recent set of data places the total at $67.7 billion for the 1981 through 1986 period.[26]

Two aspects of performance were examined for pairs of acquired and acquiring companies. Initially, 23 mergers within the oil and gas industry were identified as candidates for analysis. The candidates included only mergers between oil and gas producers. Excluded were mergers in which the primary objective was gain of assets other than oil and gas production assets. For example, mergers in which major oil companies acquired natural gas transmission companies (i.e., Occidental-MidCon) were excluded even though a significant minority of the value of acquired assets may have been in oil and gas production. Data availability resulted in a maximum of only 20 being used for any one performance measure. Of the 23 candidate acquisitions, 19 had data on finding costs for both buyers and sellers prior to the merger. In 15 of these cases, the buying company had higher relative finding costs (Table 6) than the selling company had. Further, the differences between the acquiring and acquired companies' finding costs were significantly greater than zero at the 0.09 level. In 15 of the 20 mergers, the buyer's

[21]Of course, there are other merger motives such as tax considerations or a quest for market power. These are reviewed in Mark J. Warshawsky, "Determinants of Corporate Merger Activity: A Review of the Literature," Staff Study, Board of Governors of the Federal Reserve System, April 1987.

[22]The first to discuss explicitly the role of mergers in the market for corporate control were Henry G. Manne, "Mergers and the Market for Corporate Control," *Journal of Political Economy*, April 1965, pp. 110-120 and R. L. Marris, *The Economic Theory of Managerial Capitalism*, London, MacMillan, 1964.

[23]This concept was initially popularized by Adolf A. Berle and Gardiner C. Means, *The Modern Corporation and Private Property*, New York, MacMillan, 1932.

[24]Michael C. Jensen, "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers," *American Economic Review*, May 1986, pp. 323-329.

[25]Council of Economic Advisers, *Economic Report of the President, 1985*, Washington, DC, February 1986, p. 197.

[26]Based on data in Energy Information Administration, *Performance Profiles of Major Energy Producers 1986*, (Washington, DC, January 1988) and earlier editions. The total includes Royal Dutch/Shell's gain of 100 percent ownership of Shell Oil Company.

Table 6. Comparison of Performance Measures between the Acquiring Company and the Acquired Company in Mergers within the U.S. Oil and Gas Industry over the 1982-1986 Period

Performance Measures	Percent of Mergers with Acquiring Company Value Greater Than Acquired Company Value	Number of Mergers with Data	t-Ratio for Difference between Acquiring Company and Acquired Company Value
Relative Finding Cost[a]	78.9	19	1.89[b]
Q-Ratio	25.0	12	-2.35[c]
Return on Equity	50.0	14	0.13
Cash Flow/Net Assets	28.6	14	-0.54
Long-Term Debt/Equity	38.5	13	-1.82[b]

[a]Total finding costs, excluding revisions, for the company divided by total finding costs, excluding revisions, for U.S. industry. This measure excludes purchases of reserves and the acquisition cost of reserve purchases.

[b]Significant at the 0.10 level.

[c]Significant at the 0.05 level.

Note: All ratios are calculated for year prior to the merger.

Source: Total finding costs for U.S. industry are based on totals reported in Arthur Andersen & Co., *Oil and Gas Reserves Disclosures*, 1985 and 1986 editions (Chicago, IL, 1986 and 1987). All other data sources are identified in Table 5.

relative finding costs rose in the year after the merger (Table 7). These two results imply that companies less effective in their in-house resource development tended to acquire companies that were more effective.[27] Further, since the buyer's finding costs rose in 75 percent of the mergers, there is a tentative indication that the buyers may not have effectively utilized the operating expertise acquired in these transactions.[28] While one might expect companies that were relatively undervalued by the stock market to more likely be acquisition candidates and companies with high valuations to be the acquiring company in a takeover, this did not appear to be the case in these oil and gas mergers. Of the 12 cases with adequate pre-merger data, only 3 buyers had higher relative stock market valuation than the company they bought (Table 6).[29] In other words, the companies that the market for corporate control implies are more likely to be sellers are more likely to be buyers. It is not clear, however, that the buyers improved their relative market valuation via acquisition. In 9 of 15 cases with adequate data, the buyer's market valuation fell in the year after the merger relative to the values of the acquiring company in the year prior to the merger, although the difference between the pre-merger and post-merger values for the 15 acquiring companies was not statistically significant.

The other measures presented in Table 6 and Table 7, though perhaps not as critical as finding costs and the Q-Ratios in assessing the role of the market for corporate control, are useful for discerning differences in characteristics of merging companies and post-merger performance. Profitability, as measured by return on equity, of acquiring companies and their takeover targets was not remarkably different, and although return on equity rose for only 5 of 18 acquiring companies, the intertemporal difference in profitability for the 18 companies was not statistically significant. Similarly, performance based on cash flow was not statistically different between acquiring and acquired companies even though only 4 of 14 acquiring companies had a higher ratio of cash flow to net assets than their takeover targets. However, as shown in Table 7, this ratio rose for only 3 of 18 acquiring companies in the year subsequent to the merger and the post-merger and pre-merger difference in the ratio was significantly below zero.[30] Undoubtedly, this last result was related to the sudden increase in debt and consequent increased interest burden attending a merger: in

[27]Based on FRS data for the mergers involving the majors, the acquired company on average was more highly specialized in oil and gas than was the acquiring company. This may be an indication that the former were more adversely affected by falling oil prices than were less specialized companies.

[28]A t-test on the difference was statistically significant at the 0.10 level.

[29]A t-test on the difference was statistically significant at the 0.05 level.

[30]The upward revaluation of acquired assets that typically attends a consummated merger is partially responsible for this result.

Table 7. Comparison of Performance Measures for the Acquiring Company in Mergers within the U.S. Oil and Gas Industry 1 Year Subsequent to the Merger and 1 Year Prior to the Merger

Performance Measures	Percent of Mergers with Acquiring Company Value One Year After Merger Greater Than Value One Year Before Merger	Number of Mergers with Data	t-Ratio for Difference between Post-merger Value and Pre-merger Value
Relative Finding Cost	75.0	20	1.70[a]
Q-Ratio	40.0	15	0.80
Return on Equity	27.8	18	-1.61
Cash Flow/Net Assets	16.7	18	-3.55[b]
Long-Term Debt/Equity	76.5	17	3.09[b]
Combined Share of U.S. Exploration and Development Expenditures[c]	20.0	20	-2.40[b]

[a]Significant at the 0.10 level.
[b]Significant at the 0.05 level.
[c]Includes acquired company's expenditures one year prior to merger.
Source: See notes to Tables 5 and 6.

13 of 17 cases, the debt-equity ratio rose and, averaged across the 17 acquiring companies, this ratio was significantly greater 1 year after the merger as compared to 1 year before the merger.

In summary, the results presented in Tables 6 and 7 for oil and gas industry mergers lend additional support to the proposition that the process of consolidation in the industry was, at least in part, guided by the economics of the make-or-buy decision: in nearly 80 percent of the mergers for which data were available, the acquiring company had higher finding costs than the acquired company. As an additional explanation of the process by which the oil and gas industry has undergone consolidation, the market for corporate control paradigm did not fare well in our investigation. Of particular note is the finding that in only 25 percent of the oil and gas mergers did the Q-Ratio of the acquiring company exceed the Q-Ratio of the acquired company.

Only two models have been considered as possible explanations of the process by which the U.S. oil and gas industry has undergone consolidation The method by which consolidation has been accomplished involves the concentration of oil and gas assets, primarily proved reserves, into the control of surviving companies. The findings suggest that companies with higher average finding costs tended to rely more heavily on reserve purchases to replace their production, whether by takeovers, acquisitions of other companies' oil and gas subsidiaries, or purchases of proved properties. The market for corporate control model led to disappointing results in that the patterns of profitability and investor valuation that would be expected from the model were not found among U.S. oil and gas producers. Other economic factors may have underlaid the consolidation of the industry. In his review of the major hypotheses that have been set forth as explanations of merger activity in general, Mark J. Warshawsky identified the market for corporate control, tax considerations, market power, and inefficiency in financial markets.[31] The market for corporate control in the context of the consolidation of the U.S. oil and gas industry was discussed above. Tax considerations undoubtedly played some role in that mergers create opportunities for tax planning. However, obtaining appropriate data for all oil and gas producers to assess the role of tax considerations is essentially infeasible. The market power hypothesis is of some relevance because the reduction in the antitrust authorities' impediments to mergers created additional avenues by which large quantities of proved reserves could be obtained through takeovers and mergers. However, as noted in a previous section, the Antitrust Division of the U.S. Department of Justice was of the view that mergers have not threatened competition in the U.S. oil and gas industry, and, consequently, it does not appear that the gain of market power was an objective in the

[31]Mark J. Warshawsky, *Determinants of Corporate Merger Activity: A Review of the Literature*, Board of Governors of the Federal Reserve System (Washington, DC, April 1987).

mergers within the U.S. oil and gas industry. Further, when potential competition in downstream petroleum markets was affected by mergers between petroleum companies, divestitures of assets in the relevant markets were required by the antitrust authorities as a condition for approval of the merger. The hypothesis that inefficiencies in financial markets lead to mergers is based on the proposition that takeovers may be motivated by undervaluations of equity shares. The results presented in Table 6 for the Q-Ratio do not appear to support this view for the U.S. oil and gas industry because this ratio was, on average, lower for acquiring companies than for the companies acquired in oil and gas industry mergers.

7. Implications for Resource Development

One of the important adjustments to declining oil prices has been a sharp decline in the costs of finding additional oil and gas reserves. The sharp decline in annual finding costs is apparent from data shown in Figure 2. This decline in part has been accomplished by scaling back the extent of exploration and development activity wherein higher cost projects are eliminated from consideration. A number of other factors have been instrumental in reducing finding costs as well. As the demand for inputs into the exploration and development process declined, so did the prices for these inputs through competition among drilling contractors and equipment suppliers in a shrinking market. This tendency is apparent in the fall in average U.S. drilling costs from a peak of $109 per foot in 1982 to $77 per foot in 1986.[32] With the continued slump in drilling activity in 1987, cost per foot fell to $59.[33] In the context of declining oil prices, oil and gas producers have tended to shift the focus of their exploration and development activity to less risky projects with shorter term pay backs, thereby reducing the lag between expenditures and revenues. At the height of the U.S. drilling boom and oil prices in 1981, exploration accounted for 56 percent of U.S. exploration and development spending, but this proportion declined to 39 percent in 1987.[34]

The findings of this study reveal an additional aspect of the process by which the cost of finding additional oil and gas reserves has declined. As shown in the last line of Table 7, the share of U.S. exploration expenditures accounted for by the surviving company in a takeover tended to fall relative to the share accounted for by the surviving company and its merger partner in the year preceding the merger. That is, mergers between oil and gas producers had the effect of reducing the role of the subsequently merged companies in U.S. oil and gas exploration. Since the surviving companies in oil and gas industry mergers tended to have higher finding costs both before and after the merger, a reduced role for them will tend to lessen overall U.S. finding costs.

Interestingly, the market for corporate control paradigm, although not proving very useful in understanding the process of consolidation of the U.S. oil and gas industry, does suggest that mergers between oil and gas producers should have a negative effect on exploration and development spending. According to a leading contributor to the market for corporate control literature:

> Partly as a result of Mesa Petroleum's efforts to extend the use of royalty trusts which reduce taxes and pass cash flows directly through to shareholders, firms in the oil industry were led to merge, and in the merging process they incurred large increases in debt, paid out large amounts of capital to shareholders, *reduced excess expenditures on exploration and development* [emphasis added] and reduced excess capacity in refining and distribution. The result has been large gains in efficiency and in value.[35]

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[32]Energy Information Administration, *Annual Energy Review 1987*, DOE/EIA-0384(87) (Washington, DC, May 1988).

[33]American Petroleum Institute, et.al., *Joint Association Survey of the U.S. Oil and Gas Producing Industry* (Washington, DC, December 1988).

[34]Data for 1981 are from the U.S. Bureau of the Census, Current Industrial Reports Series, *Annual Survey of Oil and Gas 1981*, MA-13K(81)-1 (Washington, DC, March 1983). Data for 1987 are from American Petroleum Institute, *Survey on Oil and Gas Expenditures* (Washington, DC, October 1988).

[35]Michael C. Jensen, "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers, *American Economic Review*, vol. 76 (May 1986), p. 327.

8. Implications for the Near Term

The impetus for consolidation of the U.S. oil and gas industry came primarily in the 1980's. If oil prices fall back to levels experienced in 1986, then the pressures to reduce resource development efforts in the United States will strengthen and further consolidation is likely. A rise in expected oil prices beyond $20 per barrel will tend to encourage expansion in efforts to discover and develop additional U.S. supplies of oil and gas until the point at which finding costs rise sufficiently to reduce the expected profitability of these activities. Forecasts of oil prices for the remainder of this decade are in the $15 to $20 per barrel range.[36] The average wellhead price of oil in 1987 fell into the low end of this range. Although it is not appropriate to project a trend on the basis of 1 year of data, the results for 1987 for the 22 majors can be placed in the context of the findings of this study.

The 22 major petroleum companies' U.S. exploratory finding costs fell from $6.69 per barrel in 1986 to $5.21 per barrel in 1987, while the cost of purchased reserves was nearly unchanged at $3.86 per barrel in 1987 compared to $3.92 per barrel in 1986 (Table 8).[37] Since the apparent spread between the make cost and the buy price was greatly reduced, the overall purchase ratio for the 22 majors fell considerably, from 32 percent to 12 percent. Differences between the high and low purchase groups of major petroleum companies continued in 1987. Although both groups showed a reduction in their reliance on reserve purchases, the high purchase group registered a much sharper drop in their reserve purchase ratio. Indeed, the pattern of the 1982 through 1986 period was reversed in 1987, with the high purchase group's reserve purchase ratio falling below that of the low purchase group. This result reflects the greater fall in the differential between the make cost and buy price for the high purchase group of $2.65 per barrel between 1986 and 1987 compared to only a $0.96 per barrel decline in the differential for the low purchase group. That is, the spread between the average cost of finding reserves through exploration and the cost of purchasing already proven reserves narrowed considerably more for the high purchase group. Accordingly, the high purchase group of companies made a much sharper reduction in their use of reserve purchases to augment their U.S. oil and gas reserves.

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[36]For example, see Energy Information Administration, *Annual Energy Outlook 1989*, DOE/EIA-0383(89)(Washington, DC, January 1989), p. 54.

[37]The computations in this section exclude Exxon's and BP America's downward revisions of Alaskan natural gas reserves of 7.8 and 5.7 trillion cubic feet, respectively, and the reserves gained by BP America in the consolidation of BP North America's operations with those of Standard Oil in 1987. The computations also exclude reserve swaps for which no expenditure values were reported.

Table 8. Finding Costs and Reserve Purchase Costs for 22 Major Petroleum Companies, 1986 and 1987

Cost Category	22 Majors [a]		
	All Majors	High Purchase Group (9 Companies)	Low Purchase Group (13 Companies)
Exploratory Finding Costs[b] (1987 dollars per barrel)			
1986	6.69	8.99	5.86
1987	5.21	6.28	4.84
Reserve Purchase Ratio[c,d] (percent)			
1986	31.7	38.8	26.2
1987	11.8	5.0	14.3
Reserve Purchase Costs[d,e] (Both Groups) (1987 barrels per barrel)			
1986	3.92		
1987	3.86		

[a]The 22 majors are Financial Reporting System companies that were not acquired during the study period.

[b]Exploratory finding costs equal unproved acreage acquisition expenditures plus exploration expenditures divided by extensions and discoveries.

[c]Reserve Purchase Ratio = 100 x reserve purchases/(reserve additions + reserve purchases). Reserve additions exclude BP America's and Exxon's 1987 combined downward revision of Alaskan natural gas reserves of 13.461 trillion cubic feet.

[d]Excludes reserves solely due to the consolidation of Standard Oil and BP North America resulting from the gain of 100 percent ownership of Standard Oil by British Petroleum plc in 1987. The 1987 figure also excludes reserve swaps for which no expenditures were reported.

[e]Reserve purchase costs equal expenditures for proved acreage divided by purchases of minerals-in-place.

Note: All averages are weighted averages.

Source: 22 Major petroleum companies: Energy Information Administration, Form EIA-28.

9. Summary and Conclusions

During the 1980's consolidation of the domestic oil and gas industry, purchases of reserves became a more prominent resource development strategy. Over the 1982 through 1986 period, both majors and independents included in this study added almost 40 percent of their domestic reserves by purchases rather than by in-house efforts. Companies tended to clearly fall into two groups: those that depended on reserve purchases to augment their U.S. oil and gas position and those that relied primarily on their own exploration and development efforts to replace oil and gas production.

The high purchase groups of majors and independents added two-thirds of their reserve additions by purchases, while the low purchase groups added less than 15 percent. For the majors, the high purchase strategy was a sharp reversal from their earlier strategy. In the 1977 through 1981 period, the majors that later adopted a high purchase strategy saw their reserves fall by 30 percent. Further, these companies' finding costs averaged three times as high as the other majors. Consequently, these companies began to rely more heavily on purchases, while companies with relatively low finding costs used their in-house capabilities to a greater extent to replace oil and gas production.

Companies that emphasized a buy rather than make strategy tended to be relatively high cost in their own resource development efforts. Further, the high purchase group of major companies tended to be less profitable than the majors that emphasized in-house resource development efforts, and investors tended to place a lower valuation on the prospects of the high purchase group relative to the low purchase group of major companies.

These differences were also confirmed by examining data for acquiring and acquired companies in oil and gas mergers in the 1982 through 1986 period. Our results tend to support the view that the economics of the make or buy decision, at least in part, underlaid the motivations to follow differing strategies during the period of consolidation of the oil and gas industry. By contrast, our results do not lend support to the market for corporate control paradigm as a significant explanation for the consolidation of the industry.

The high purchase groups of majors and independents spent more than 40 percent of their exploration and development budgets on purchases of proved reserves over the 1982 through 1986 period, while the low purchase groups spent less than 10 percent of their budgets on purchases of proved reserves. As the high purchase companies cut back or eliminated high-cost projects from their exploration and development portfolios and substituted purchases, the spread between average finding cost and average purchase cost was narrowed. The spread fell by $5 per barrel for the high purchase group of majors and by $3 per barrel for the high purchase group of independents. Recent data indicate that the spread was largely eliminated for the majors in 1987. Accordingly, reserve purchases fell sharply between 1986 and 1987, which is consistent with our findings with respect to the role of the make or buy decision.

Appendix
Companies Included in the Study

High Purchase Group of Major Oil Companies:

Burlington Northern Inc
Chevron Corp
Coastal Corp
Kerr-McGee Corp
Mobil Corp
Occidental Petroleum Corp
Phillips Petroleum Co
Texaco Inc
USX Corp

Low Purchase Group of Major Oil Companies:

Amerada Hess Corp
American Petrofina
Amoco Corp
Ashland Oil Inc
Atlantic Richfield Co
E.I. Du Pont De Nemours and Company
Exxon Corp
Shell Oil Co
Standard Oil Co
Sun Co Inc
Tenneco Inc
Union Pacific Corp
Unocal Corp

High Purchase Group of Independent Oil and Gas Companies:

AMCOLE Energy
American Exploration
American National Petroleum
American Oakwood
Apache Corp.
Aspen Exploration
Baruch-Foster
Bayou Resources Inc.
Brock Exploration
Burton/Hawks
Canadian Occidental Petroleum
Canadian Pacific Ltd.
Chieftain Development
Consolidated Oil & Gas
Convest Energy
Crescent Oil & Gas
Damson Oil Corporation
Dietrich Resources
Div. Energies/Dyco Petroleum
Dorchester Energy
Eagle Exploration
Enex Resources
Enron (HNG/Internorth)
Ensource, Inc.
Evergreen Resources
Falcon Oil & Gas
Fossil Oil & Gas
Freeport-McMoran
Goodyear/Celeron
Greenwood Resources
Hadson Corporation
Hamilton Oil Corp
Harken Oil & Gas
Hershey Oil
J M Resources
Kimbark Oil & Gas Co.
Kirby Exploration Co Inc
KRM Petroleum Corporation
Louisiana Land & Exploration
Marlin Oil
May Energy Ptrs. (MLP)
May Petroleum
Maynard Oil
McFarland Energy
MCO Resources, Inc.
Midland Southwest Corp
Minden Oil and Gas
Monogram Oil & Gas
Moore McCormack
MSR Exploration Ltd.
Nicor
Oxoco
Pacific Lighting Corp.
Pangea Petroleum
Partners Oil
Petro-Lewis
Petrotech
Plains Resources Inc
Sage Energy
Sceptre Resources
Seahawk Oil International
Search Natural Res.
Strata Corp.
Sunshine Mining
Swift Energy
Terrapet Energy
Texas International
Texon Energy Corporation
Tipperary Corp.
Total Petroleum
Tpex Exploration
Trans Atlantic
Triton Energy
Unit Corp. (unit D. & E.)
Valex Petroleum
Wainoco Oil
Western Natural Gas
Whiting Petroleum
Woodbine Petroleum
Wright Bros. Energy

Low Purchase Group of Independent Oil and Gas Companies:

ALAMCO
Alexander Energy
Allegheny & Western
Alta Energy
Altex Industries
Anadarko Petroleum (Panhandle Eastern)
Arch Petroleum Inc.
Asamera
Beard Oil
Belcor Inc.
Bellwether Exploration
Blackgold Energy Resources
Bogert Oil
Bronco Oil & Gas
Cabot Corp.
Callon Petroleum
Calumet Industries
Cenergy Corp. (Centex)
Chaparral Resources
Cheyenne Resources
Cimarron
Columbia Gas System
Columbine Exploration
Conquest Exploration
Consolidated Natural Gas
Credo Petroleum
Crown Central Petroleum
Crystal Oil
Deca Energy
DeKalb Corp
Diamond Shamrock
Discovery Oil
Double Eagle Petroleum
Drillers Inc.
EMC Energies
Energy Oil
Energy Ventures
Enserch
Equitable Resources
First Mississippi
Forest Oil
Georesources
Golden Oil Co.
Great Eastern Energy
Gulf Resources & Chemical Corp.
Helmerich & Payne
Henry Energy
HLH Petroleum
Homestake Mining Company
Howell Corp.
Imperial Energy
Inter-City Gas
Intramerican Oil & Minerals
Kencope Energy
Lyric Energy
Magic Circle Energy Corp.
Mapco
MDU Resources Group
Merit Energy
Midwest Exploration
Mitchell Energy
Murphy Oil
Newmont Mining
Noble Affiliates
Northern Michigan Exploration
NP Energy
Nugget Oil Corp.
Oakridge Energy Inc
Odeco
Omni Exploration
Oneok Inc
Page Petroleum
Pantepec International
Park-Ohio Industries
Pauley Petroleum
Pennzoil
Petx Petroleum
Plano Petroleum
Premier Resources
Presidio Oil
Pyramid Oil Company
QED Exploration
Quaker State Oil Refining
Questar Corporation
Ratex Resources, Inc.
Regal Petroleum
Resource Exploration Inc.
Ridgeway Exco
Roberts Oil & Gas
Royal Resources Corp
Sabine Corp.
Sage Drilling
Santa Fe So. Pacific
Saxon Oil
Seagull Energy
So. Texas Drilling. & Exploration
Sonat Inc
Southdown Inc
Southern Mineral
Southern Union Company
Southwestern Energy Co
Sparton Corp.
Striker Petroleum
Summit Energy
Templeton Energy
Texas American Energy
Texas Eastern Corp.
Texas Gas Resources (CSX)
Texoil
Tidewater
Toklan Oil
Tom Brown
Tosco Corp.
Transco Energy
Tyrex Oil
Universal Resources
W.R. Grace
Westburne International
Wilshire Oil
Winco Petroleum
Wiser Oil
Zapata

Table A1. Merger Pairs

Acquiring Company	Acquired Company	Year
Adobe Resources	Vanderbilt Energy	1984
Barrett Resources	Excel Energy	1985
Burlington Northern	Southland Royalty	1985
Chevron	Gulf Oil	1984
Damson Oil Corporation	Dorchester Gas	1984
Diamond Shamrock	Natomas	1983
Egret Energy	Target Oil & Gas	1985
Enron (HNG/Internorth)	Belco Petroleum	1983
Global Natural Resources	Cambridge Royalty	1986
Louisiana Land & Exploration	Inexco Oil	1986
MCO Resources, Inc.	Integrated Energy	1984
Mesa	Pioneer Corp.	1986
Mobil	Superior Oil	1984
Occidental Petroleum	Cities Service	1982
Petromark Resources Co.	Ike Lovelady	1985
Phillips Petroleum	General American Oil	1983
Placer Development	Prairie Producing	1984
Snyder Oil Partners	Energy Oil	1986
Sunshine Mining	Woods Petroleum	1985
Sunshine Mining	Texas Energies	1985
Templeton Energy	Amarex	1986
Texaco	Getty Oil	1984
USX	Texas Oil & Gas	1986

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